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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/507,325	09/10/2004	Hideki Morita	APA-0216	2850

74384 7590 12/29/2009

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EXAMINER	
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ART UNIT	PAPER NUMBER
1791	

MAIL DATE	DELIVERY MODE
12/29/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/507,325	**Applicant(s)** MORITA ET AL.	
	Examiner JASON L. LAZORCIK	**Art Unit** 1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 September 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5* is/are pending in the application.

4a) Of the above claim(s) *5* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Status of the Claims

Applicants reply dated September 1, 2009 amends claim 1. All other claims stand as previously presented in Applicants reply dated February 4, 2009.

Claims 1-5 are pending in the Application

Claim 6 stands as having been cancelled by Applicant

Claim 5 has been withdrawn from consideration for being drawn to a non-elected invention

Therefore, Claims 1-4 are currently pending for prosecution on the merits.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. The term "closest to" in claim 1, line 25 is a relative term which renders the claim indefinite. The term "closest to" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Specifically it is not

evident what point of reference is employed to determine close, closer and closest to (e.g. closest compared to what?).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart (US 6,337,462 B1).

Smart broadly teaches a system and method used for processing a brittle material, such as silicon, by illuminating said brittle material with light of an optimized wavelength.

<u>(I) Smart is silent regarding the step of irradiating a sample</u>

Smart presents data in figure 1 which details the absorption coefficient as a function of wavelength wherein said data was obtained upon a sample of the same brittle material intended for the processing steps. Smart is silent regarding the step of "irradiating a light onto a plate-shaped sample with a plurality of wavelength" as recited in claim 1, line 2

(II) Irradiation of the plate shaped sample is obvious over Smart and the ordinary level of skill in the art at the time of the invention.

Although the Smart reference is silent regarding the method employed to obtain this data set, it is the Examiners position that said data was either implicitly obtained by irradiating a light with a plurality of wavelengths onto a sample of the brittle material, or alternately that such a measurement would have represented a merely trivial extension over the Smart teachings for one of ordinary skill in the art at the time of the invention.

Specifically, one of ordinary skill would recognize the data presented in figure 1 as corresponding to a conventional absorptance data in the near-IR wavelength range. Applicants claimed method of acquiring such a spectrogram, namely by irradiating light having a plurality of wavelengths onto a “plate-shaped” sample would be recognized as merely routine and conventional to a skilled artisan. Similarly a skilled practitioners would be apprised of the established mathematical correlation between absorbance, irradiation intensity, absorption coefficient, and the sample thickness commonly referenced as the Beer-Lambert law. Conventional spectrometers measure light intensity (e.g. absorptance or transmittance) as a function of wavelength, and it follows

in view of the Beer-Lambert law that the figure 1 plot of absorption coefficient versus wavelength must therefore account for the sample thickness.

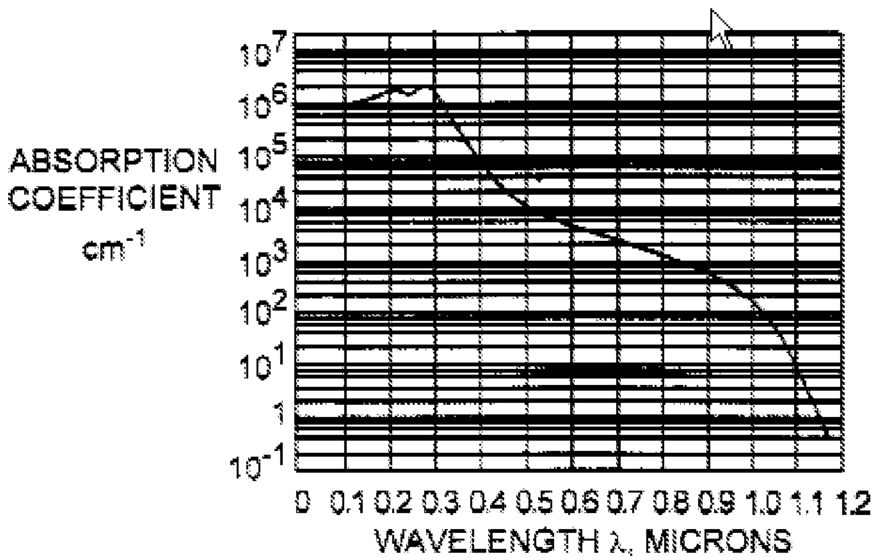

FIG. 1

In short, the data presented by Smart in figure 1 imply the execution of Applicants claimed steps of

1) irradiating a light onto a plate-shaped sample with a plurality of wavelengths

Alternately, it is the Examiners position that such steps are merely conventional and would represent a trivial and routine measure for skilled practitioners in view of the Smart disclosure.

Next, Smart teaches (Column 5, line 63 to column 6, line 14) a value of absorptance of the plate shaped sample is calculated for incident radiation at wavelengths of 1.047 and 1.2 microns. This absorptance (I/Io) is calculated based upon a set value of absorptance (e.g. fig 1) and a thickness (x) of the plate-shaped sample.

Specifically, the illumination wavelength is set or selected to be at a wavelength beyond the absorption edge of about 1.1 microns (Column 2, Lines 10-12) in order to minimize thermal processing damage to the substrate.

In view of the calculated absorptance values (e.g. 86.5% at 1.047 microns versus 1% at 1.2 microns) and the actual absorptance data from figure 1, Smart determines that irradiation at 1.2 microns is an optimal wavelength for processing of the brittle material. This optimal wavelength for processing the brittle material is "set in advance" and it is the examiners position that during the processing, a light source with the optimal wavelength is at least partially absorbed by the sample and "serves as a heating source onto the brittle material". It is further noted that the sample is mounted upon a table (34) which serves as a "reflective layer" [**Claims 3, 4**] on the rear side of a light irradiating position and that the sample is repeatedly advanced into position along “a predetermined line”.

Smart discloses that the selected wavelength of light plays an important role in effectively processing the brittle substrate material without subjecting said brittle material to excessive heating and damage. Since Smart selects a wavelength for which the brittle material is largely transparent, it should appear evident that this optimum wavelength "permits a region of an internal material portion of the brittle material and the surface vicinity of the brittle material to become an absorbing region by the irradiation of the light onto the brittle material”.

As noted above, it is implicitly understood from the absorbance coefficient plot presented in figure 1 that the sample(s) of material used to generate said plot were irradiated “in sequence” by at least one light source having a plurality of mutually exclusive wavelengths. Should Applicant argue that Smart nowhere explicitly stated that the sample data of figure 1 was acquired using a plurality of different sources having exclusive wavelengths, then it is the Examiners position that one of ordinary skill in the art would have been fully capable of obtaining the sample absorptance data by any conventional means available in the art at the time of the invention [**Claim 2**].

Restated, the preferred method of acquiring the sample absorptance data is not deemed particularly germane to the method of using said data to select an appropriate irradiation wavelength for the processing of the brittle material. It follows, absent any compelling evidence to the contrary, it would have been just as obvious to acquire individual absorptance data points for the sample material using, for example, a plurality of monochromatic sources (lasers) of mutually exclusive wavelengths as it would have been to utilize a single broadband source paired with a monochrometer. At the very least, it would have been obvious for one of ordinary skill in the art to try the plurality of light sources at the time of the invention.

.

<u>(III) Smart is silent regarding Applicants recited step for calculating the absorptance based upon Formula (I)</u>

The Smart reference instructs (Column 5, line 63 – Column 6, line14) that the chosen wavelength affects the depth to which the incident radiation penetrates the substrate. In this passage, Smart lays out the particular relationship between illumination depth, material absorbance, and wavelength which would have represented a significant concern to processing the buried features of particular concern in the reference (Column 8, lines 15-48). Further, Smart teaches that a minor change in the illumination wavelength results in a drastic change in absorption efficiency.

Smart is silent regarding the step of calculating the absorptance of the plate-shaped sample by Formula (I) and selecting a wavelength of light to make "the actual absorptance of the plate shaped sample" near to "the calculated absorptance"

<u>(IV) Calculation of absorptance based upon the Formula (I) would have been obvious for one having an ordinary level of skill in the art at the time of the invention.</u>

Now, with respect to the calculation of absorptance by Formula (I) as recited in amended claim 1, Applicant was previously advised that the mathematical relationship presented by the Beer-Lambert Law would be readily appreciated by one of ordinary skill in the art. Specifically, the Beer-Lambert Law;

$$T = \frac{I_1}{I_0} = 10^{-\alpha l} = 10^{-\epsilon l c}$$

Teaches that Transmissivity (or Absorbance/100) is related to the absorption coefficient of the material (α) and the thickness of the material (l). Applicant derives Formula (I) from the well known Beer-Lambert Law in the bridging paragraphs between

pages 5 and 6 of the Specification. Steps (1) through (3) of this derivation appear to be simple mathematical transforms of the basic Beer-Lambert Law as presented above. In Steps (4) and (5), applicant appears to merely derive the expected absorbance value of a sample having a thickness d to a sample of the same material having a different thickness D. That is, Formula (5) from the Specification and its equivalent Formula (I) in the instant claims, constitutes no more than a mathematical relationship showing that the absorptance of a sample of material having a set thickness can be predicted based upon a known absorptance value of a piece of the same material having a different thickness

The fundamental Beer-Lambert Law equation and its present transforms would be viewed as elementary considerations for one of ordinary skill in the art. As Smart has shown above, the optimum wavelength is selected based upon the inherent transmission properties of the material being processed and upon the thickness of said material. One of ordinary skill would reasonably be expected to perform the instant calculations in order to insure that light of the optimum wavelength would penetrate to an effective depth in the brittle material.

Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arisawa (US 6,906,283).

Ariwasa teaches a method for precision working of a substrate by employing a laser illumination source having a wavelength which is adjusted to match the

wavelength of absorption of the substance of interest (see specifically col. 1, lines 11-17; col. 2, line15-61; col.3, line49 to col. 5, line 19).

As evidenced by figure 2, Ariwasa teaches irradiating a sample of the material to be processed by a plurality of wavelengths to obtain transmittance versus wavelength data. Ariwasa teaches selection of an optimal wavelength of light for processing a same glass material having the spectrum of figure 2 (col. 6, lines 61-64).

Ariwasa discloses that the illumination wavelength may be selected to promote one or many photon absorption processes tuned to a wavelength either near to resonance or off resonance with an absorption band in the substrate(col. 5, line 43 to col. 7, line15) . With reference to Examples 1 and 2 (col. 10, line66 to col. 11, line 25; col. 5, lines 5-19), Ariwasa teaches that judicious choice of wavelength permits efficient processing at the surface of the glass material and creation of a uniform processing region within “an internal material portion of the material" as recited in claim 1.

Ariwasa discloses that the recited method may be employed to cutting or drilling operations (col. 8, lines 38-39) which the Examiner construes to read upon or render obvious the recited step of “moving an irradiation position of the light along a predetermined line”.

(I) Ariwasa does note disclose calculation of the absorptance value by the recited formula

Ariwasa is silent regarding the step of calculating the absorptance of the plate-shaped sample by Formula (I) and selecting a wavelength of light to make "the actual absorptance of the plate shaped sample" closest to "the calculated absorptance"

(II) Calculation of absorptance based upon the Formula (I) would have been obvious for one having an ordinary level of skill in the art at the time of the invention.

Ariwasa explicitly teaches the selection of the wavelength for processing the brittle material may be tuned to permit selective processing of an interior portion of the material at a predetermined depth.

As noted in the grounds of rejection above and with respect to the calculation of absorptance by Formula (I) as recited in amended claim 1, Applicant was previously advised that the mathematical relationship presented by the Beer-Lambert Law would be readily appreciated by one of ordinary skill in the art. Specifically, the Beer-Lambert Law;

$$T = \frac{I_1}{I_0} = 10^{-\alpha l} = 10^{-\varepsilon l c}$$

Teaches that Transmissivity (or Absorbance/100) is related to the absorption coefficient of the material (α) and the thickness of the material (l). Applicant derives

Formula (I) from the well known Beer-Lambert Law in the bridging paragraphs between pages 5 and 6 of the Specification. Steps (1) through (3) of this derivation appear to be simple mathematical transforms of the basic Beer-Lambert Law as presented above. In Steps (4) and (5), applicant appears to merely derive the expected absorbance value of a sample having a thickness d to a sample of the same material having a different thickness D. That is, Formula (5) from the Specification and its equivalent Formula (I) in the instant claims, constitutes no more than a mathematical relationship showing that the absorptance of a sample of material having a set thickness can be predicted based upon a known absorptance value of a piece of the same material having a different thickness

The fundamental Beer-Lambert Law equation and its present transforms would be viewed as elementary considerations for one of ordinary skill in the art. As Ariwasa has shown above, the optimum wavelength is selected based upon the inherent transmission properties of the material being processed and upon the desired depth of material to be processed. One of ordinary skill would reasonably be expected to perform the instant calculations in order to insure that light of the optimum wavelength and of sufficient intensity would penetrate to the working depth in the brittle material.

Regarding **claim 2** and as noted above, it is implicitly understood from the transmittance plot presented in Ariwasa figure 2 that the sample(s) of material used to generate said plot were irradiated by at least one light source having a plurality of mutually exclusive wavelengths. Should Applicant argue that Ariwasa nowhere

explicitly stated that the sample data of figure 1 was acquired using a plurality of different sources having exclusive wavelengths, then it is the Examiners position that one of ordinary skill in the art would have been fully capable of obtaining the sample transmittance data by any conventional means available in the art at the time of the invention [**Claim 2**].

Restated, the preferred method of acquiring the sample transmittance data is not deemed particularly germane to the method of using said data to select an appropriate irradiation wavelength for the processing of the brittle material. It follows, absent any compelling evidence to the contrary, it would have been just as obvious to acquire individual transmittance data points for the sample material using, for example, a plurality of monochromatic sources (lasers) of mutually exclusive wavelengths as it would have been to utilize a single broadband source paired with a monochrometer. At the very least, it would have been obvious for one of ordinary skill in the art to try the plurality of light sources at the time of the invention.

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Regarding **claims 3 and 4**, where Ariwasa teaches that the instant process is applicable to laser drilling or cutting of substrates, use of a table or “reflective surface” to support the workpiece during processing would have constituted an obvious extension over the prior art teachings for one of ordinary skill in the art at the time of the invention.

Response to Arguments

Applicant acknowledges that Smart discloses relationships between material absorptance and wavelength, however Applicant alleges that Smart fails to disclose a step of “selecting a wavelength or a light source to achieve absorptance of a desired value according to the thickness of the substrate” (see page 9).

In response, the Examiner acknowledges that the recited step of selecting an “optimum wavelength” is based broadly upon the calculated value of absorptance (A) which is in part dependent upon the thickness of the brittle material to be processed (D). This step is not equivalent to the purported step of “selecting a wavelength” to achieve absorptance of a desired value according to the thickness of the substrate” as argued above. In response to applicant's argument that the references fail to show certain features of applicant’s invention, it is noted that the features upon which applicant relies (i.e., wavelength is chosen to achieve absorptance of a desired value according to the thickness of the substrate) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Further, the claimed invention in no manner delineates what constitutes an "optimum" wavelength other than to note that said wavelength permits material in the surface vicinity of the substrate and an interior portion of the substrate to become absorbing regions during irradiation of a workpiece with said wavelength.

Applicants arguments with respect to the transform of the Beer-Lambert law have been fully considered but are deemed unpersuasive.

As explained in the prior Official Action and as reiterated above, the intensity of an illumination source a given depth in a workpiece is a common consideration for skilled practitioners in the art as is the relationship set forth by the Beer-Lambert Law. Applicants derived equation constitutes no more than simple arithmetic rearrangement of the Beer-Lambert Law to demonstrate that the absorbance of a substrate having one known thickness can be predicted based upon a measured absorptance of a substrate of the same material having a different thickness. This relationship constitutes an elementary transformation of the Beer-Lambert equation which would have been viewed as an obvious extension over the prior art teachings by a nominally skilled practitioner in the arts at the time of the invention.

Applicants arguments with respect to the use of the terms “permits" and “allows" in the recited invention have been considered but are unpersuasive. The position on this matter stands as previously presented.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The United States patent to Drummond et. al. (US 6,841,024) underscores the Examiners position regarding the conventional nature of the Beer Lambert law for light transmission through a workpiece (Col. 1, lines 54-64). The United

States Pre-Grant Publication to Kwan (US 2004/0150688) similarly teaches (see particularly ¶[0006-0008] that use of the Beer Lambert law to predict laser light transmission through a workpiece is a routine task and specifically states that the “ability to predict or otherwise identify a laser light transmissivity characteristic of a work piece before the piece undergoes" work by the laser is a recognized process variable deemed conventional to those skilled in the arts. Finally, the reference to Ihlemann et al (Appl. Phys. A 54, 363-368 (1992)) teaches that it is known to optimize the wavelength of light used to process a given brittle substrate material.

As referenced in the previous Official Action, Lapham (US 4,399,345) teaches selective processing of brittle substrates by optimization and tuning of the irradiation wavelength and is understood to apply under 35 U.S.C. 102(b)/103(a) according to similar arguments presented above for the Smart (US 6,337,462 B1) reference. Leong et. al. (US 5,611,946) present a multi-wavelength laser cutter system for processing brittle substrates similar to Smart and Lepham. Any reply to the instant Official Action should carefully consider the scope and content of each of these disclosures.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JASON L. LAZORCIK whose telephone number is (571)272-2217. The examiner can normally be reached on Monday through Friday 8:30 am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on (571) 272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jason L Lazorcik/
Primary Examiner, Art Unit 1791